Space Weather Forecast

Issued on Thursday, 30 November 2023 at 13:12 Local

This forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Moderate flares likely (R1-R2 Blackouts). G1-G2 Minor to Moderate storms likely, with a slight chance G3 Strong storms, due to multiple coronal mass ejection arrivals day 1-2 (30 Nov-01 Dec)

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Low, with only common class flares observed, the largest of which was at 29/1435 UTC, from the moderately large sunspot region in the southwest of the disc. There are currently twelve sunspot regions with the largest the aforementioned region in the southwest. This region has been the most active and comprises of a cluster of small dark-core spots, with a relatively simple magnetic structure. Some spreading of the spots was observed, but also some development of new spots within the intermediate portion of the group. All other regions on the disc remain smaller and simpler, and generally either stable or showing signs of decay. There are also a number of filaments visible, which are lines of material held together by the Sun's Magnetic field. These can erupt to produce coronal mass ejections (CMEs)

No Earth-directed CMEs occurred during this period, however there are a number of other potentially Earthbound CMEs in the forecast from previous days.

Solar Wind / Geomagnetic Activity: Solar wind speeds were Slightly Elevated to Background at first, 380-420 km/s, but decreased to around 350km/s by the end of the period. Interplanetary Magnetic Field (IMF) was weak, with the north-south component also varying weakly but predominately negative (southward orientated). Geomagnetic activity was Quiet (Kp1-2).

Energetic Particles / Solar Radiation: The count rate of energetic particles (high energy protons) persisted at background with no solar radiation storms occurring.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate with isolated Moderate flares (R1-R2 Blackout) likely, and a slight chance of an isolated Strong class flare (R3 Blackout). The moderately sized sunspot in the southwest of the disc is most likely to be the source.

Solar Winds / Geomagnetic Activity: There are up to four Earth-directed CMEs. Three from 27 Nov, and the other, a more significant CME, originated from the Moderate flare on 28 Nov. Two CMEs are likely to arrive day 1 (30 Nov), with glancing impacts most likely, but could combine into a more notable enhancement. The M9.8 sourced CME is forecast to arrive during the morning of day 2 (01 Dec), although the speed of this CME is low confidence, allowing for a chance of an arrival as early as late on day 1 (30 Nov). This CME is also likely to sweep up and cannibalise the fourth CME, which was forecast to arrive later on day 2 (01 Dec), potentially enhancing the impact when this occurs. Aside from the CMEs, current Slightly Elevated to Background winds are forecast to continue easing. Geomagnetic activity is initially expected to be mainly Quiet. The CME arrivals are then likely to bring spells of G1/Minor or G2/Moderate geomagnetic storms on day 1 or more likely day 2 (30 Nov or 01 Dec) with a slight chance of G3/Strong storms. Geomagnetic activity then easing day 3 (02 Dec) although there remains a chance of isolated G1 Minor Storms, before returning to mainly Quiet by day 4 (03 Dec).

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This activity brings a chance of visible aurora to parts of the UK on days 1-2 (30 Nov-01 Dec), however the strongest activity is currently signalled to be during daylight hours, which would limit potential visibility to northern Scotland. There is a slight chance of views as far south as northern England, Wales and Northern Ireland given good views of the northern horizon.

Energetic Particles / Solar Radiation: The count rate of energetic particles (high energy protons) is expected to stay at background. However, any significant flares from the large spot will bring a chance of flux levels increasing, with a slight chance of approaching or perhaps exceeding the S1 Minor Radiation Storm level.

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Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	40	70	20	1
Strong	G3	No	10	25	1	1
Severe	G4	No	2	5	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	60	55	45	45
Very Active	R3 to R5 X	No	10	10	10	10

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	10	10	10	10
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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